



# Using Demand Response to supply transmission ancillary services

**Transmission Research Program Discussion Group  
Tuesday, September 29, 2009**

**Dave Watson**

**Mary Ann Piette, Sila Kiliccote, Rish Ghatikar**

**Lawrence Berkeley National Laboratory**

**Demand Response Research Center**

<http://drcc.lbl.gov/>



## Presentation Outline

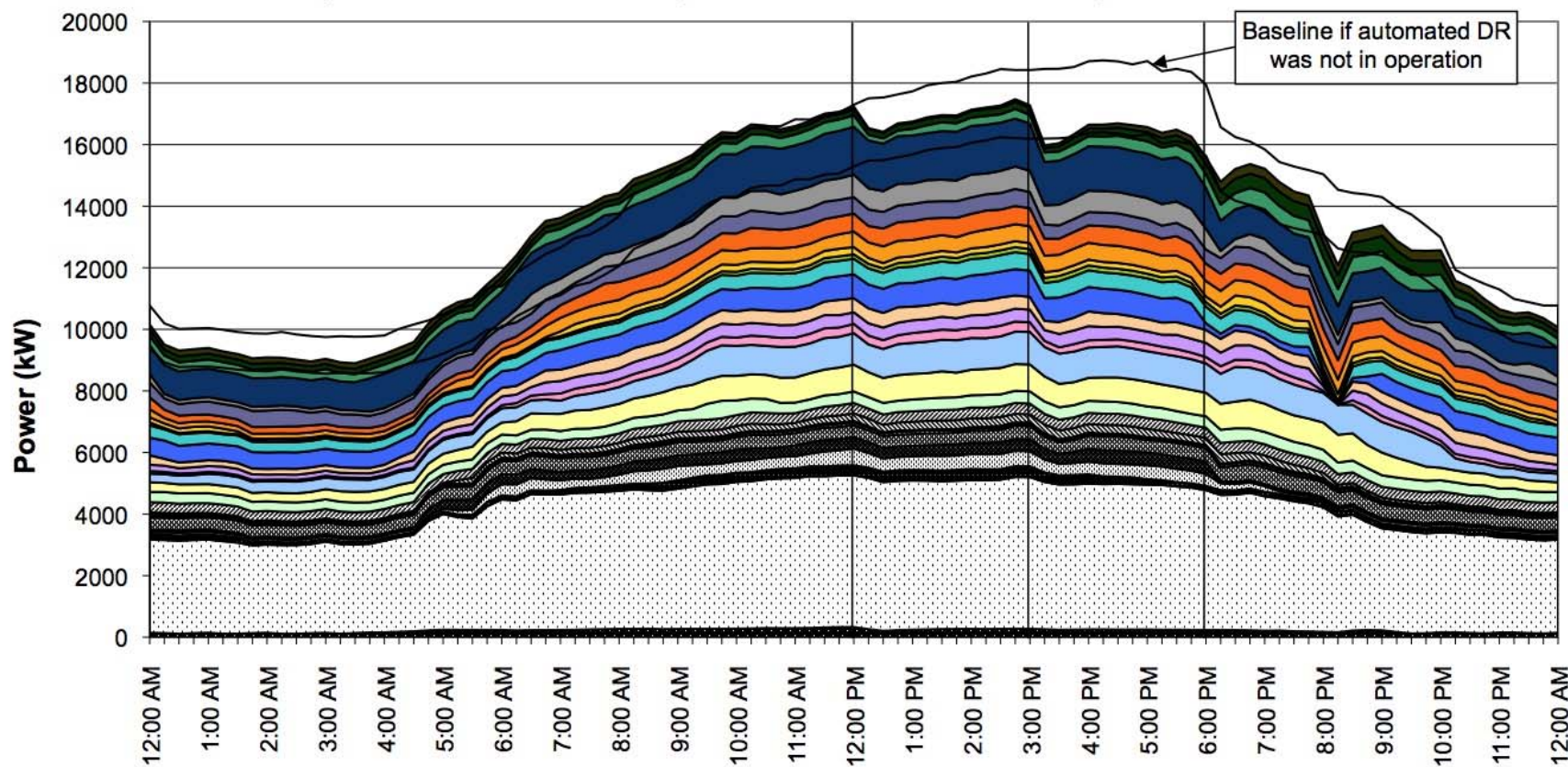
### **Executive Summary**

1. **AutoDR**
2. **Use in wholesale markets/ancillary services**
3. **OpenADR - NIST Smart Grid Standards**
4. **Next Steps**



# 2009 Automated DR Event

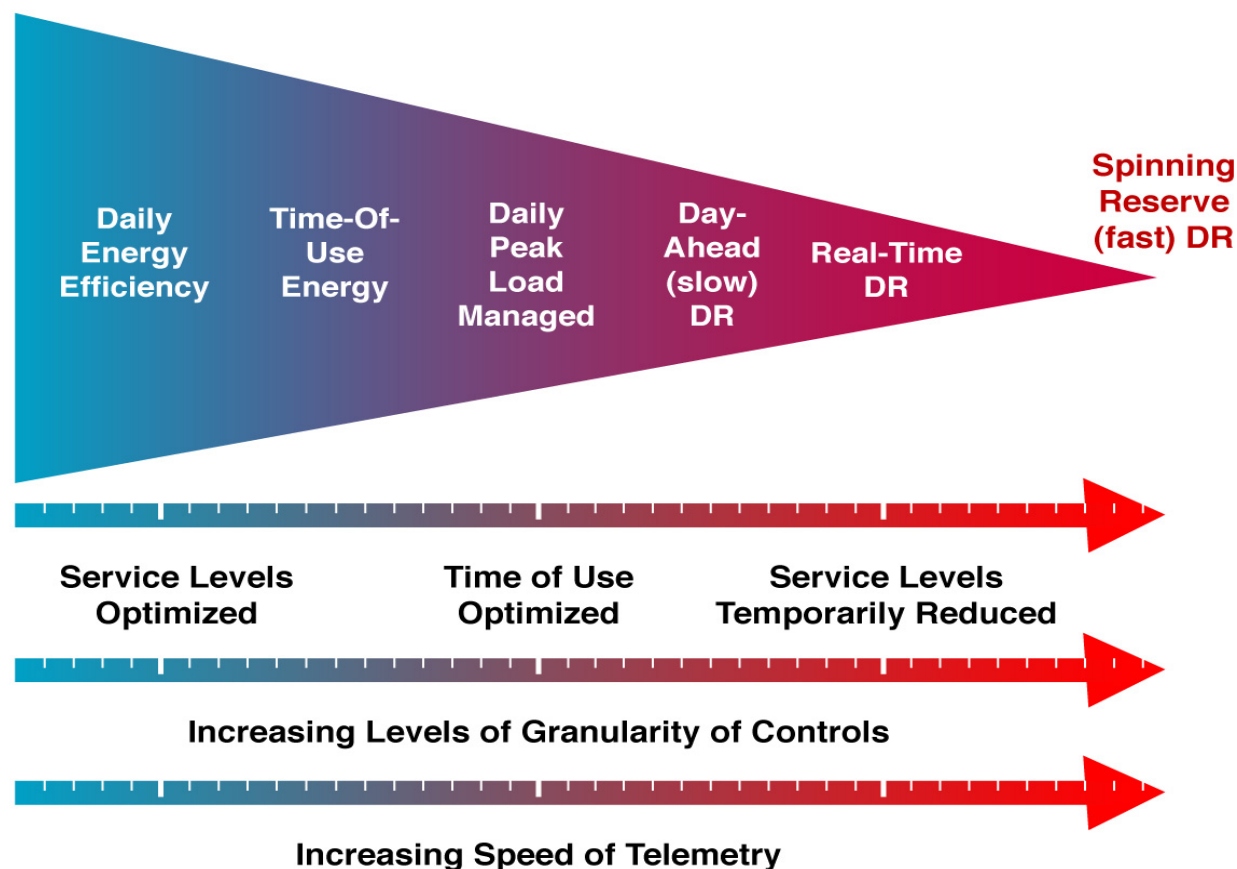
**Aggregate Customer Loads for the Automated Critical Peak Pricing Event on 7/9/2008**  
**Fully Automated Demand Response Reduce Peak Demand by 2.2 MW**





# Linking Efficiency\* and DR

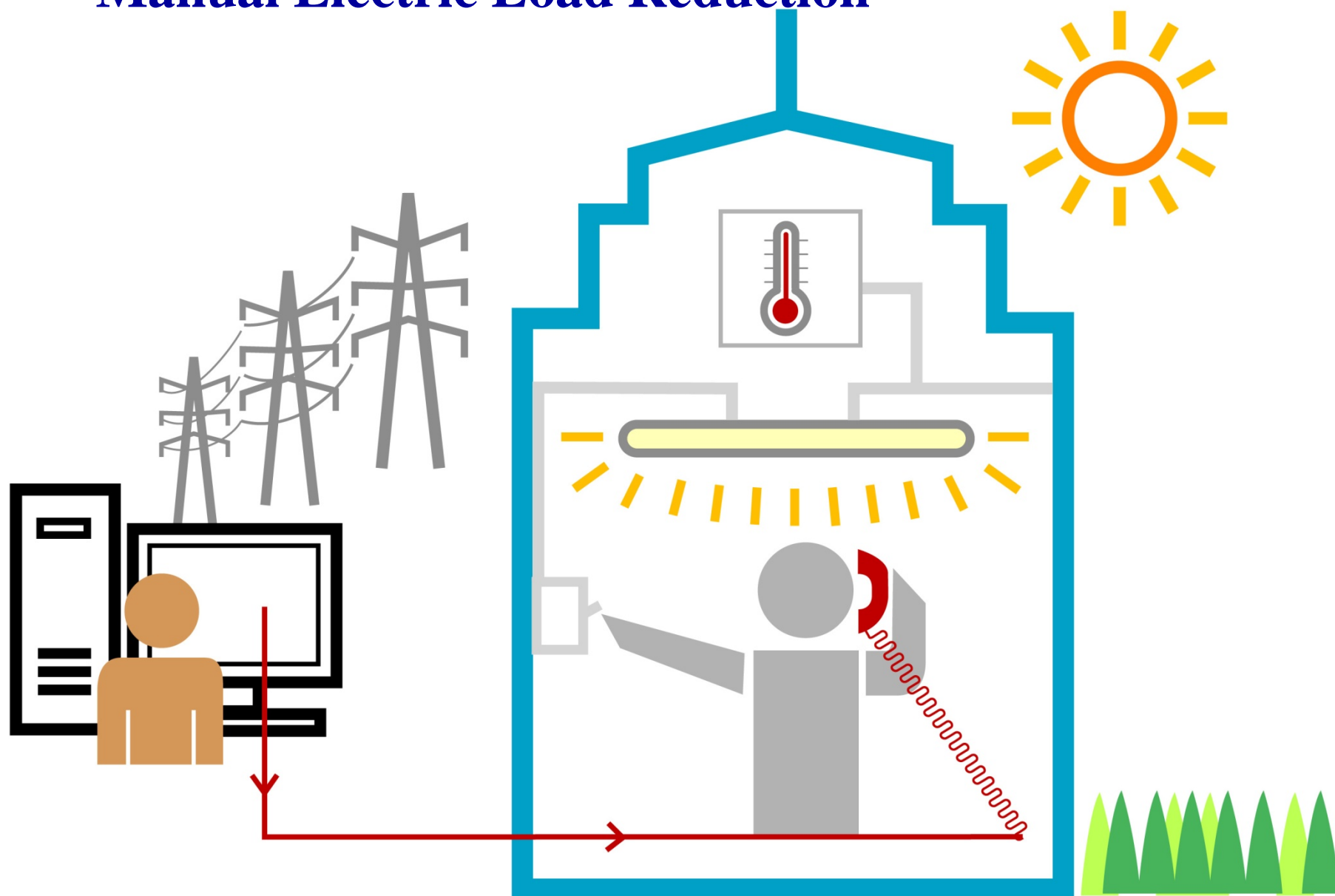
## Technical, Commercial and Policy Impact



*\*Do you know what your building is doing?*

Need to make performance **visible!**

# Manual Electric Load Reduction



The diagram illustrates the DRAS (Data Remote Access System) architecture for smart building energy management. It shows a central building with a thermostat and a temperature display showing 76°. A person wearing sunglasses stands outside the building. To the left, a server rack and a computer monitor are shown, with a person sitting at the desk. A yellow DRAS device is connected to the building's thermostat and the server rack. A dollar sign icon indicates the system's role in cost management. The sun is shown in the top right corner, and power lines are in the top left corner.



## **Demand Response as a Resources in Wholesale Markets**

### **Participating Load Pilot Project 2009 (Piette, et al.)**

- ★ **Objective: DR (C&I) meets requirements for non-spinning reserves:**

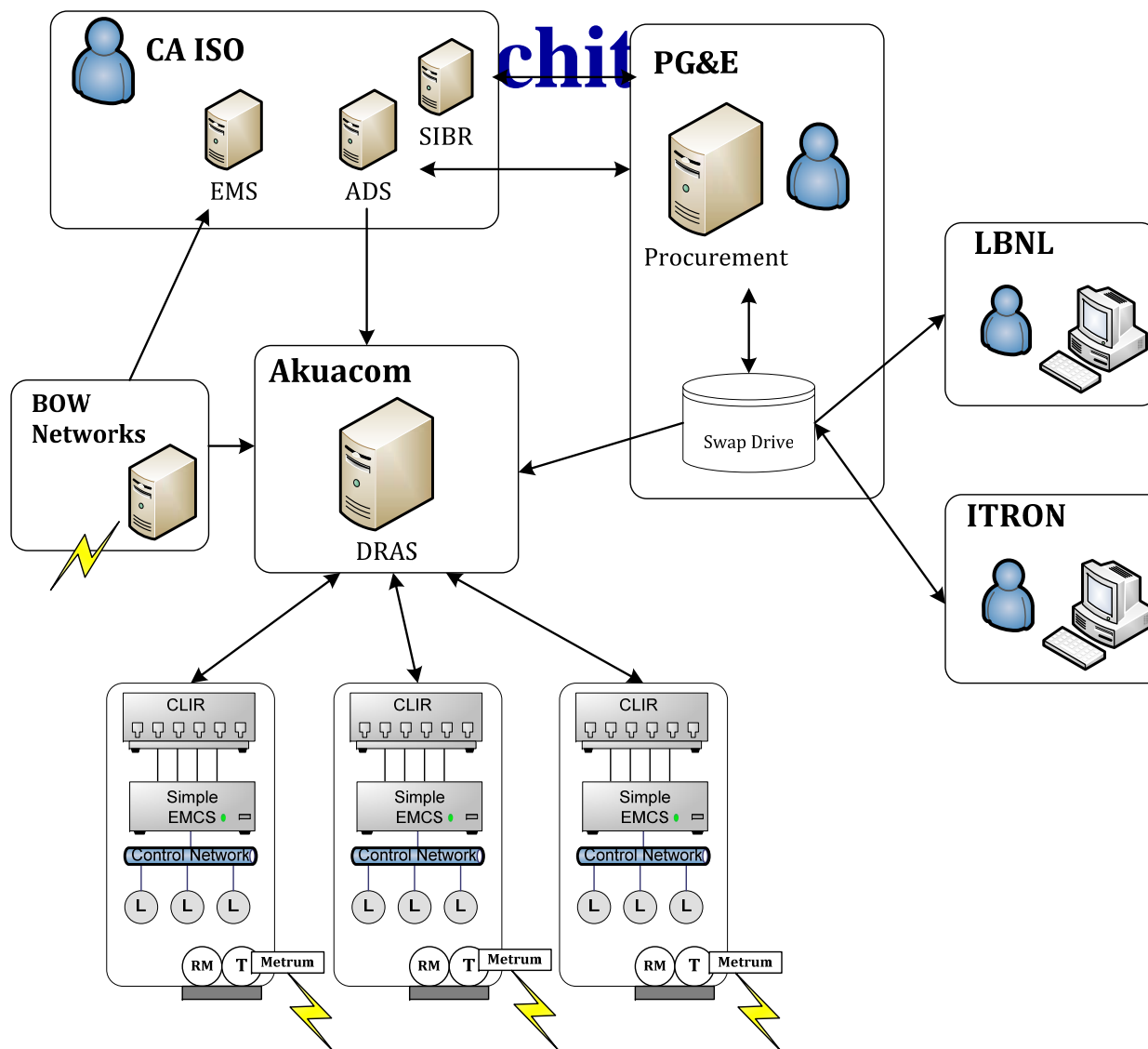
- ◆ Resources within 10-minutes
- ◆ Available for 2 hours
- ◆ provide real-time telemetry to the CAISO

- ★ **Preliminary Findings:**

- ◆ Demand-response resources can provide full response significantly faster than required by reliability rules:
  - North American Electric Reliability Corporation (NERC) and Western Electric Coordinating Council (WECC) rules for contingency reserve response (both spinning and non-spinning)



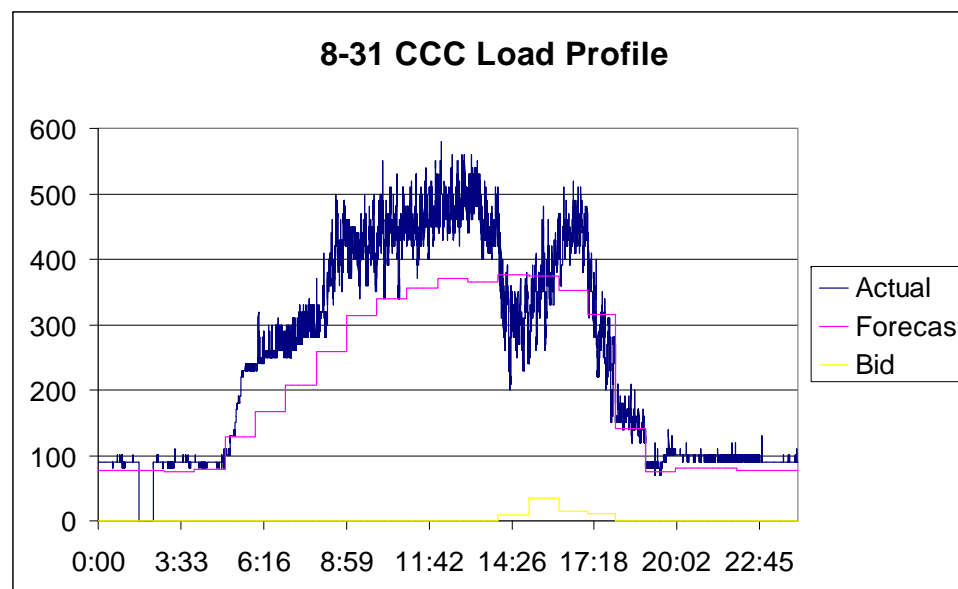
# Participating Load Pilot (PLP)





# Results – Contra Costa County Aug 31, 2009

Minutes	Time	Actual kW	Drop kW	Hour Forecast	Bid
0	2:00 PM	430.00	0.00	375.53	9.23
1	<b>2:01 PM</b>	<b>420.00</b>	<b>10.00</b>	<b>375.53</b>	<b>9.23</b>
2	2:02 PM	370.00	60.00	375.53	9.23
10	2:10 PM	300.00	130.00	375.53	9.23
50	2:50 PM	240.00	190.00	375.53	9.23
60	3:00 PM	240.00	190.00	375.05	34.30
<b>Averages</b>					
"1 - 60"	"2-3 PM"	312.71	117.29	375.53	9.23



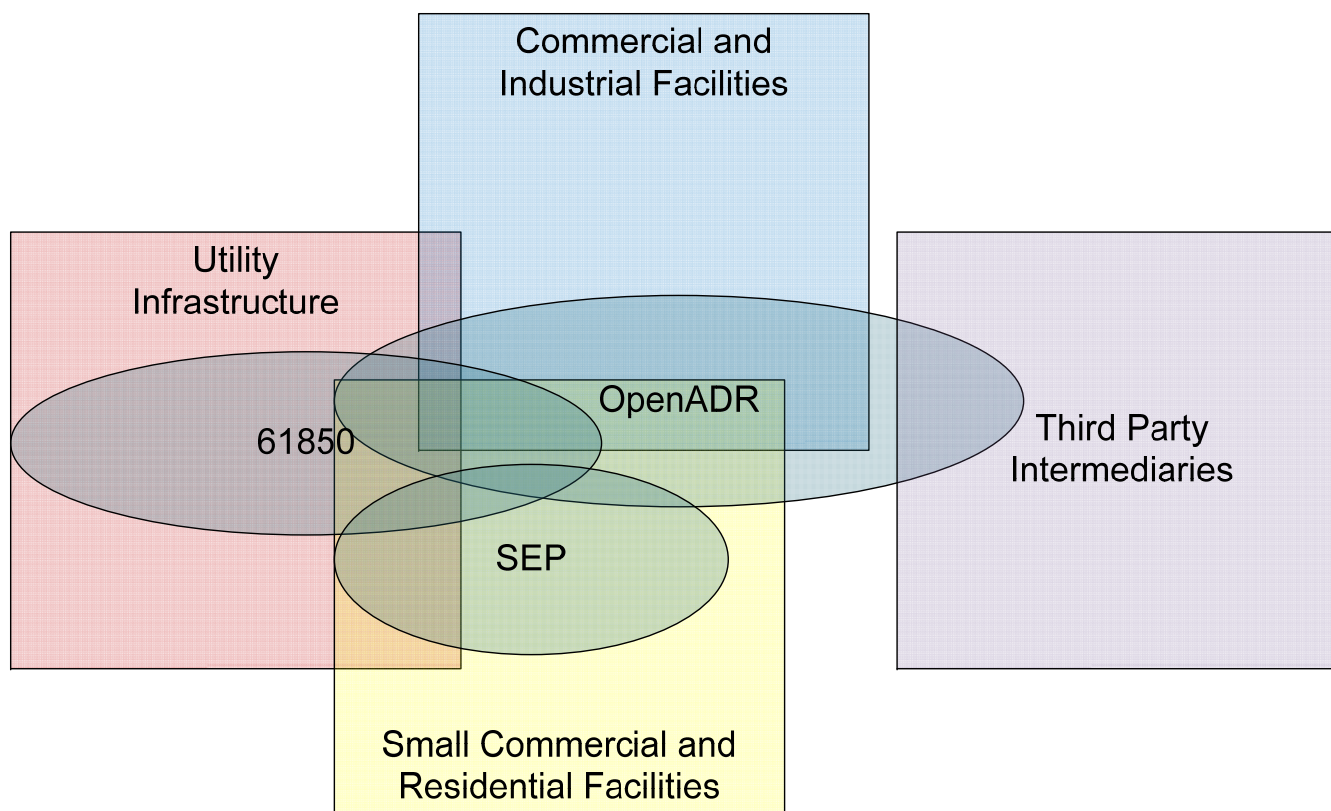


## Smart Grid Standards Activity

- ★ **Per (NIST) “The Smart Grid is a vital component of President Obama's comprehensive energy plan”**
- ★ **The OpenADR specification was selected by NIST as one of the 16 standards “for inclusion in Release 1.0 of the Smart Grid Interoperability Standards Framework.**
- ★ **Formal standards work is underway with:**
  - ◆ OASIS (Organization for the Advancement of Structured Information Standards)
  - ◆ UCAI (Utility Communications Association International)
  - ◆ IEC – International Electrotechnical Commission



## OpenADR and Other Industry Standards





## Summary and Next Steps

- Create a transition plan / automation goals for long term wide spread automation of DR
- Define collaborative research needs to more fully integrate DR with wholesale markets & ancillary services
- Controls industry capable of large scale implementation of OpenADR if policy makers committed to its adoption
- Adoption of OpenADR in control systems allows enabling automation at low cost
- Provide maximum societal benefit to peak demand reduction by promoting standards based automation
- Need to harmonize data models for price response



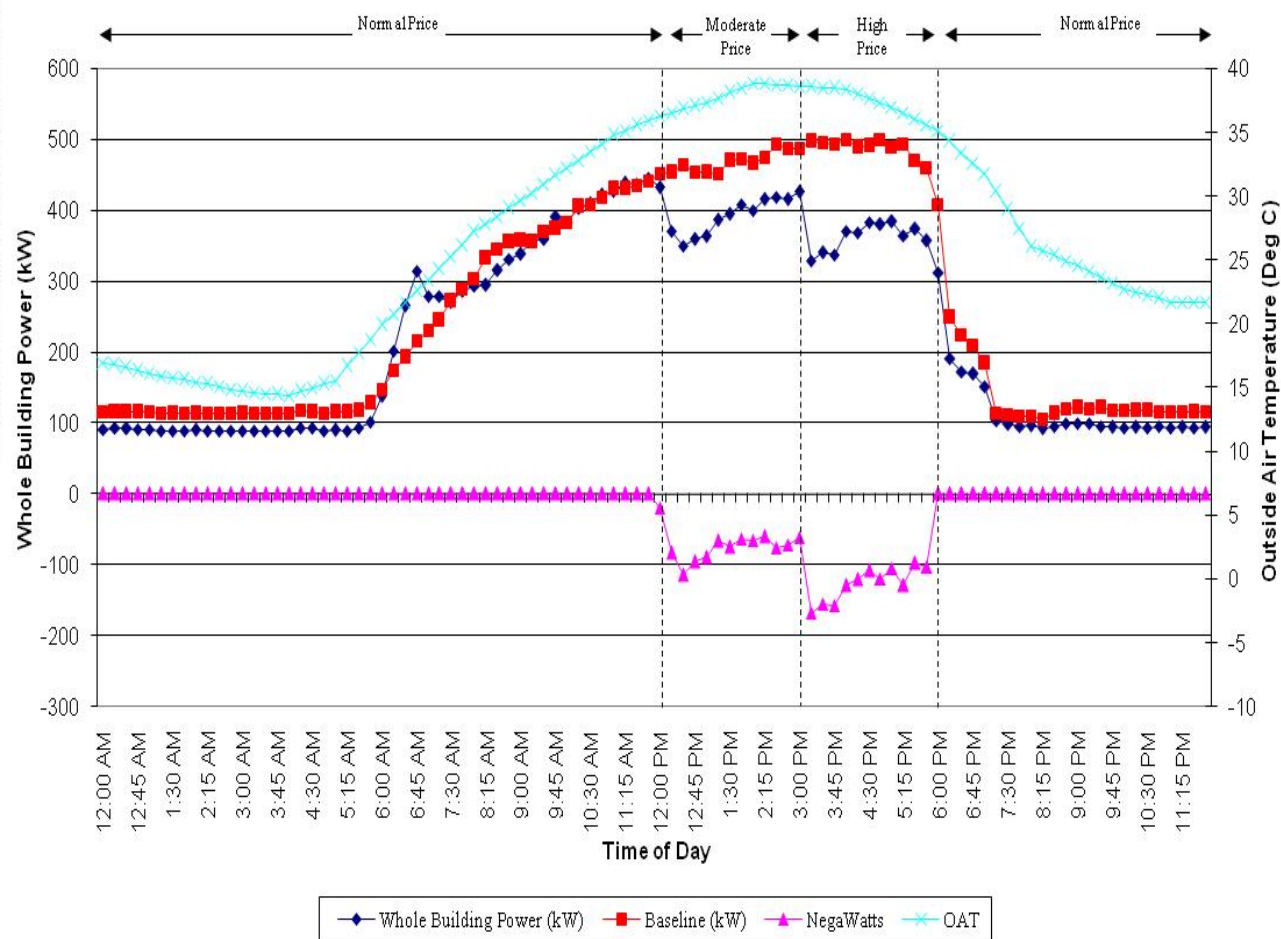
# Questions?

★ **Comments?**



# Auto-DR in 130,000 ft<sup>2</sup> County Office Current Practice

Martinez, CA Office Building Electricity Use with and without AutoDR  
June 21, 2006



#### 4. Industry Adoption of Open Auto-DR Data Model



	Vendor	Sector or Business	End-Use	Status
1	Adura Technologies	Commercial	Lighting	Completed
2	Advanced Telemetry	Technology Integrator	Automation Systems	Completed
3	Advantech	Technology Integrator	Automation Systems	Completed
4	Automated Logic Corp	Commercial	HVAC	Completed
5	Beckhoff	Commercial	Lighting	In discussion
6	BPL Global	Commercial/Residential	HVAC/Others	In process
7	Cassatt Corp	Industrial	Data Center Servers	Completed
8	Convergence Wireless	Commercial	Lighting	In discussion
9	Cypress Systems	Commercial/Industrial	HVAC/Others	Completed
10	Daikin Industries Ltd	Commercial/Industrial	HVAC	NA
11	Eaton	Commercial	Lighting	Completed
12	Echelon	Technology Integrator	Automation Systems	Completed
13	Emacx Systems	NA	NA	NA
14	Energy ICT	Technology Integrator	Automation Systems	NA
15	e-radio USA	Technology Integrator	RDS/FM, etc	NA
16	Federspiel Controls	Commercial/Industrial	HVAC	Completed
17	Honeywell	Commercial	HVAC/Others	In discussion
18	Invensys/Wonderware	Industrial	SCADA/HMI	Completed
19	Kw Aware	Technology Integrator	Automation Systems	Completed
20	LumEnergi	Commercial	Lighting	Completed
21	Lutron	Commercial	Lighting	Completed
22	Lynxspring	Technology Integrator	Automation Systems	NA
23	Millennial Net	Commercial/Industrial	HVAC/Others	Completed
24	PowerIT	Industrial	Refrigeration	Completed
25	Red Dwarf Technologies	NA	NA	In discussion
26	Regen Energy	Technology Integrator	HVAC/Lighting/Others	NA
27	Richards Zeta (Cisco)	Commercial	HVAC/Lighting	Completed
28	RTP Controls	Technology Integrator	Automation Systems	Completed
29	Site Controls	Technology Integrator	Automation Systems	Completed
30	Stonewater	Technology Integrator	Automation Systems	Completed
31	Tendril	Residential	HVAC/Others	Completed
32	Universal Devices	Commercial/Residential	HVAC/Lighting/Others	Completed
33	Wattstopper	Commercial	Lighting	In discussion



# Comparison of End-Use Strategies

	Building use	HVAC										Lighting					Other	
		Global temp. adjustment	Duct static pres. Increase	SAT Increase	Fan VFD limit	CHW temp. Increase	Fan qty. reduction	Pre-cooling	Cooling valve limit	Boiler lockout	Slow recovery	Extended shed period	Common area light dim	Office area light dim	Turn off light	Dimmable ballast	Bi-level switching	Non-critical process shed
ACWD	Office, lab	X	X	X		X			X	X		X						
B of A	Office, data center		X	X	X	X			X									
Chabot	Museum	X						X										
2530 Arnold	Office	X									X							
50 Douglas	Office	X									X							
MDF	Detention facility	X																
Echelon	Hi-tech office	X	X	X			X						X	X	X	X		
Centerville	Junior Highschool	X						X										
Irvington	Highschool	X						X										
Gilead 300	Office			X														
Gilead 342	Office, Lab	X		X														
Gilead 357	Office, Lab	X		X														
IKEA EPaloAlto	Furniture retail	X																
IKEA Emeryville	Furniture retail	X																
IKEA WSacto	Furniture retail																	
Oracle Rocklin	Office	X	X															
Safeway Stockton	Supermarket																X	
Solectron	Office, Manufacture	X												X				
Svenhard's	Bakery																	X
Sybase	Hi-tech office													X				
Target Antioch	Retail	X					X											
Target Bakersfield	Retail	X					X											
Target Hayward	Retail	X					X						X				X	
Walmart Fresno	Retail	X															X	

Global temperature reset migrating to State Energy Code